030-051-6354-A

TUNNEL RECONNAISSANCE
Part I

TEC LESSON 030-051-6354-A

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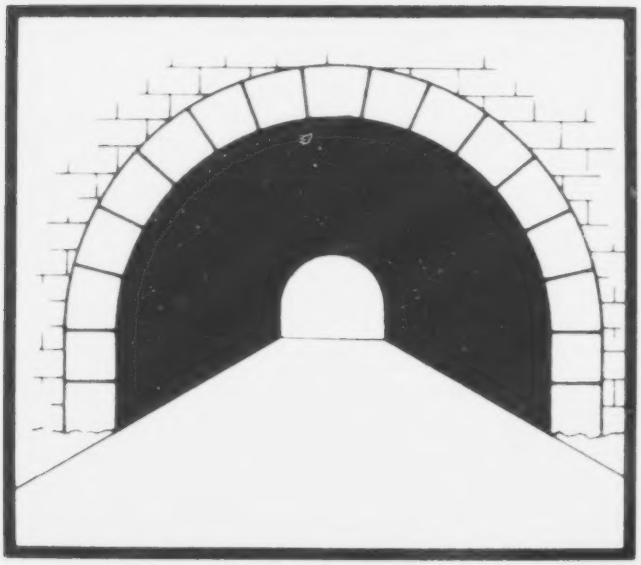


PRODUCED BY
UNITED STATES ARMY
ENGINEER SCHOOL
FORT BELVOIR, VIRGINIA 22060

STUDENT/SUPERVISOR INSTRUCTIONS, PRETEST/POSTTEST, AND ANSWER KEY ARE CONTAINED IN THIS BOOK.

REVISED
JUNE 1985

READ THE STUDENT/SUPERVISOR INSTRUCTIONS CAREFULLY. BE SURE YOU UNDERSTAND THEM COMPLETELY BEFORE BEGINNING THE LESSON. PLEASE DO NOT WRITE IN THIS BOOK.

The words "he," "his," and "men," when used in this publication, represent both the masculine and feminine genders, unless otherwise specifically stated.

STUDENT/SUPERVISORY INSTRUCTIONS

TYPE OF LESSON

- Tunnel Reconnaissance

AUDIENCE

- MOS 12B—Combat Engineer
- Skill Levels One and Two

TRAINING OBJECTIVES

Soldiers completing this lesson will be able to:

- Identify the main parts of a tunnel.
- Obtain the required tunnel dimensions and measurements.

MATERIAL/EQUIPMENT/PERSONNEL REQUIRED

- Pencil and Paper
- DA Form 1250

TIME REQUIRED

- Individual: 50 minutes
- Group: 60 minutes

REFERENCES

- FM 5-34
- FM 5-36

READEX FICHE best copy available

STUDENT/SUPERVISORY INSTRUCTIONS

STUDENT INSTRUCTIONS

- Prerequisites: TEC Lesson 030-051-6351-F
- Take the Pretest/Posttest. If you pass, you do not have to take the lesson.
- Make sure you have the material, equipment, and personnel required to complete the lesson.
- Take the lesson.
- When you complete the lesson, take the Pretest/Posttest again. If you do not pass, take the lesson again.

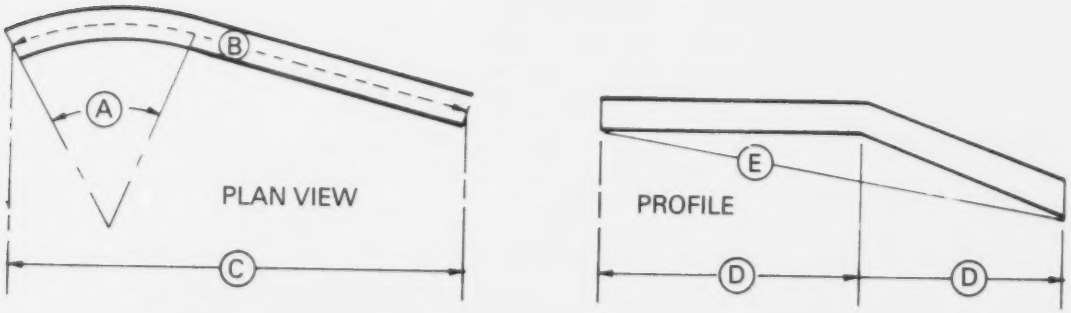
SUPERVISOR INSTRUCTIONS

- Make sure students have completed the prerequisites listed in the Student Instructions.
- Administer the Pretest/Posttest to determine need for the lesson. If only one soldier is being tested, the test may be taken directly from the book, with response made on a separate sheet of paper. If more than one soldier is being tested, reproduce the test for direct use. To pass the test, a soldier must answer 100% of the items correctly.
- Make sure students have the material, equipment, and personnel required to complete the lesson.
- Administer the lesson to students who do not pass the Pretest/Posttest.
- Administer the Pretest/Posttest to students who complete the lesson. Those who do not pass must take the lesson again.

TEC LESSON 030-051-6354-A
Tunnel Reconnaissance
Part I

This test consists of 10 questions that cover every training objective of the lesson. These questions have a total value of 100 points. When you have completed the test, check your answers against the Pretest/Posttest Answer Key. If you do not score at least 100 points, you must take the lesson—or take it again if you have already taken it. If you are taking the test directly from the instruction book, write your answers on a separate sheet of paper.

Number your paper 1-5. Study the following Plan View and Profile View of a tunnel. Place the appropriate letter next to the measurement taken at that spot. You may use FM 5-34.



1. Tunnel length along centerline _____

2. Change in percent of slope _____

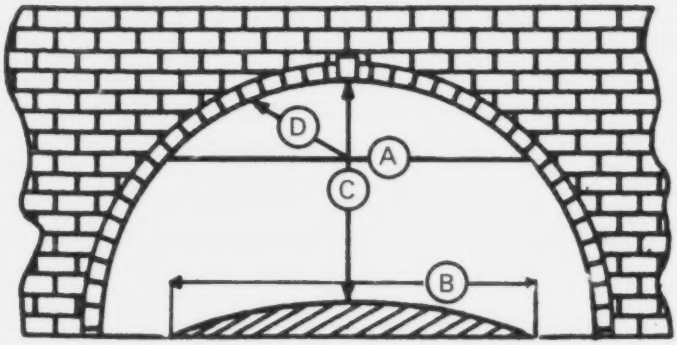
3. Radius of curvature _____

4. Portal to portal tunnel length _____

5. Percent of slope _____

PRETEST/POSTTEST

Number your paper 6-10. Study the following Portal View of a tunnel. Place the appropriate letter next to the measurement taken at that spot. You may use FM 5-34.



6. Rise of tunnel arch _____

7. Horizontal clearance _____

8. Width of traveled way _____

9. Overhead clearance _____

10. When is an overhead clearance considered an obstruction?

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INTRODUCTION

As NCOIC of a tunnel reconnaissance, you are responsible for obtaining dimensions and measurements to prepare DA Form 1250, the Tunnel Reconnaissance Report.

In this lesson you will learn what dimensions and measurements to collect during the tunnel reconnaissance.

There are two main steps in conducting a tunnel reconnaissance:

1. Identify the main parts of a tunnel.

2. Obtain the required tunnel dimensions and measurements.

① Identify the Parts of a Tunnel

In this section you will learn to identify characteristics of the three main parts of a tunnel:

Tunnel Bore

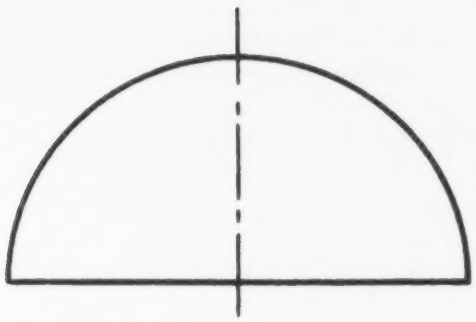
Tunnel Lining

Tunnel Portal

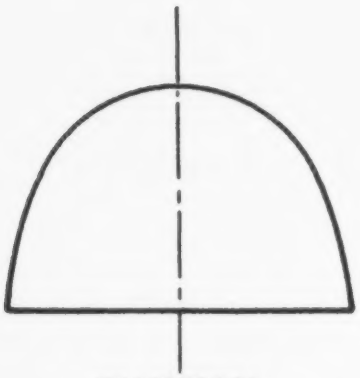
Turn the page to begin. . .

① Parts of a Tunnel (Cont.):

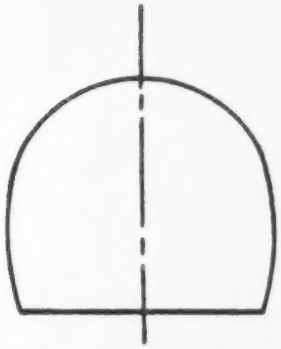
TUNNEL BORE



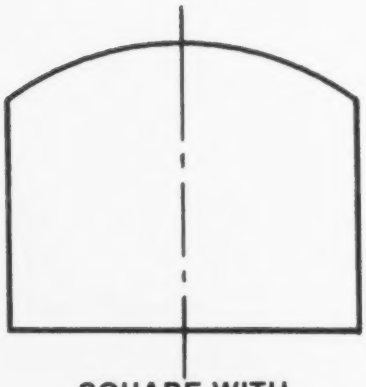
SEMI-CIRCULAR



ELLIPTICAL



HORSE-SHOE



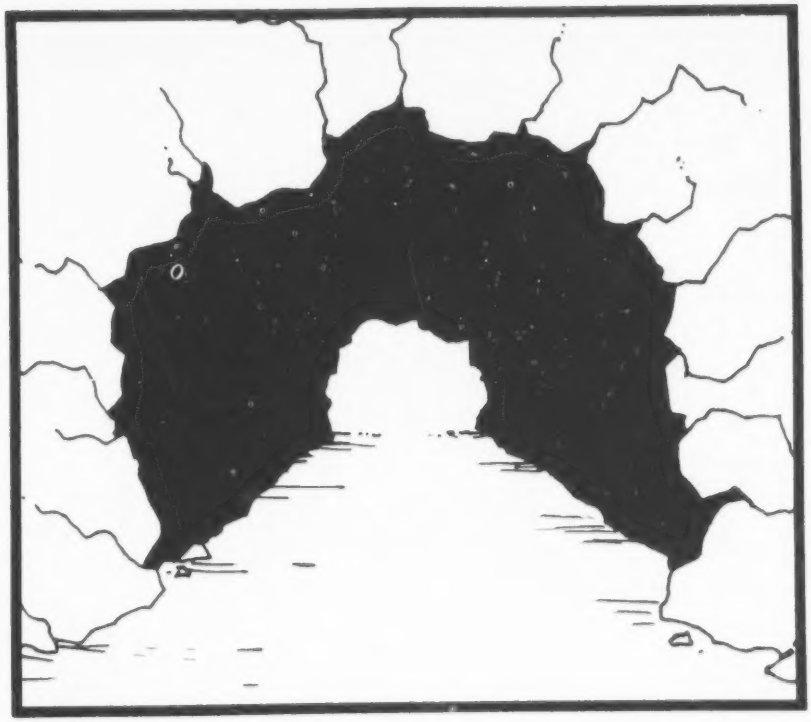
SQUARE WITH
ARCHED CEILING

The tunnel bore is the shape or style of the tunnel.

Study these diagrams of the four most common shapes of tunnel bores.

① Parts of a Tunnel (Cont.):

TUNNEL LINER



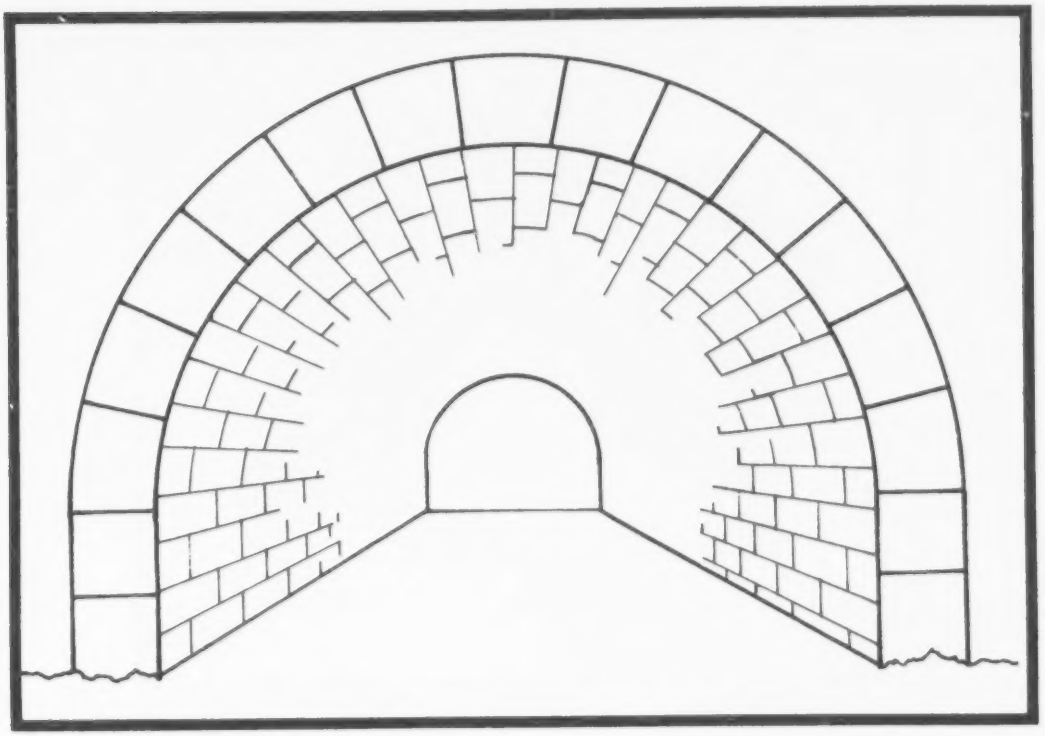
UNLINED TUNNEL

The tunnel liner is the material you find on the inside of the tunnel walls.

Study this diagram of a typical unlined tunnel.

① Parts of a Tunnel (Cont.):

TUNNEL LINER

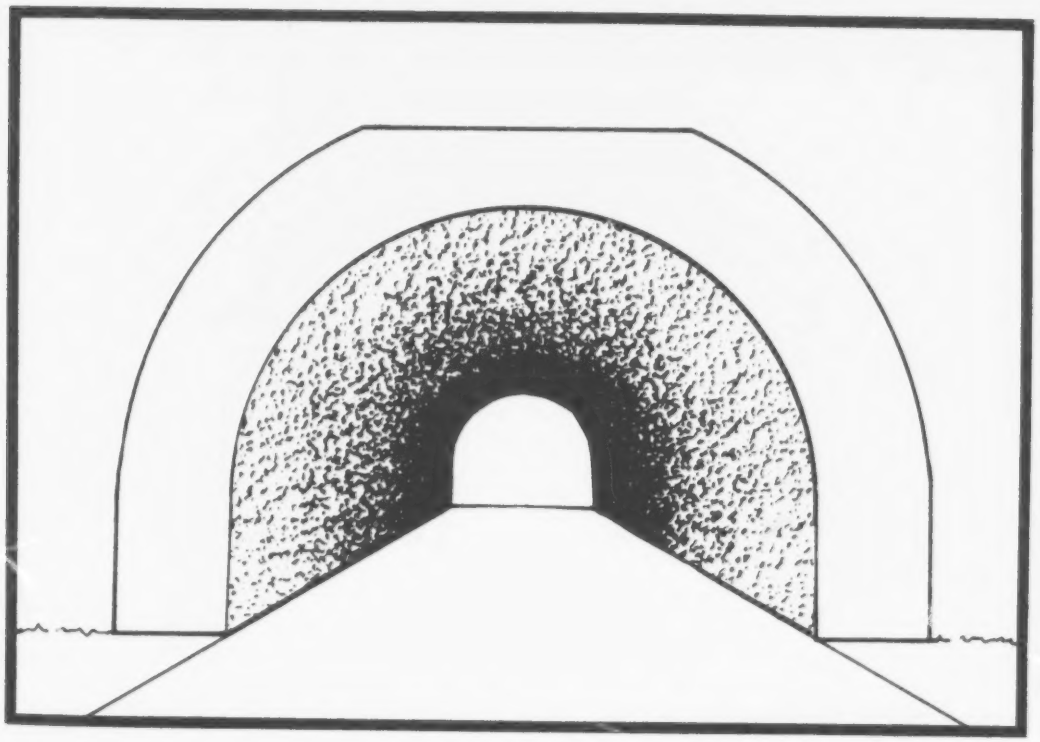


TYPICAL MASONRY-LINED TUNNEL

A masonry-lined tunnel is lined with brick. This type of tunnel liner is stable and commonly used.

① Parts of a Tunnel (Cont.):

TUNNEL LINING

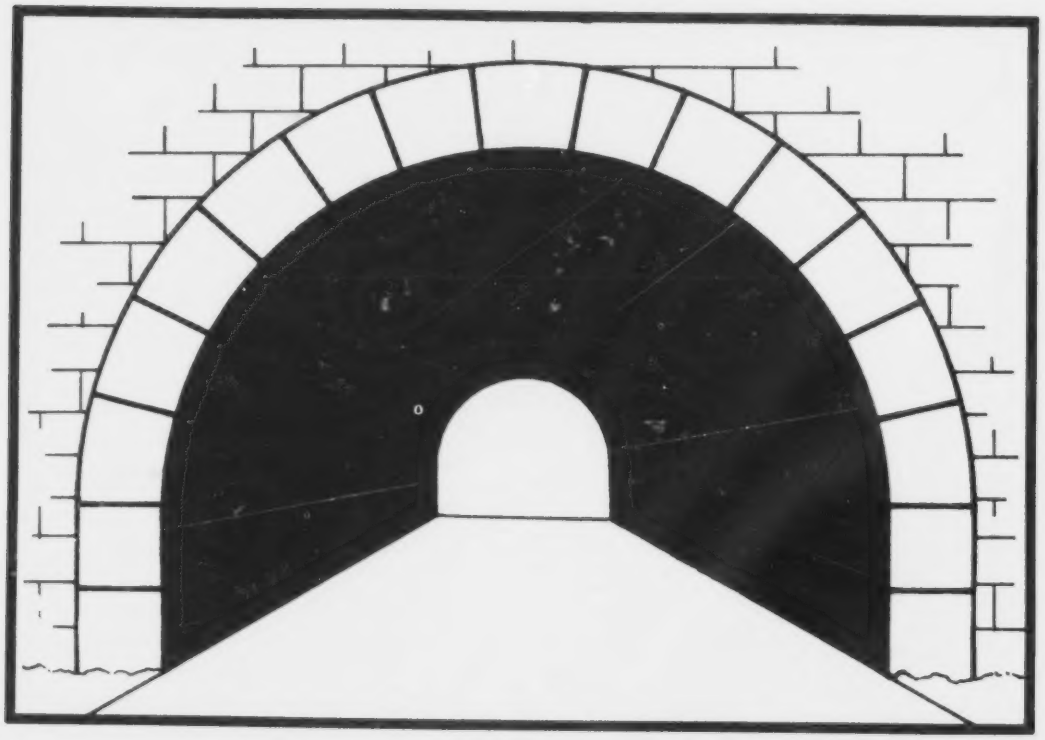


TYPICAL CONCRETE-LINED TUNNEL

A concrete-lined tunnel is the most stable and reinforced type of tunnel.

① Parts of a Tunnel (Cont.):

TUNNEL PORTAL

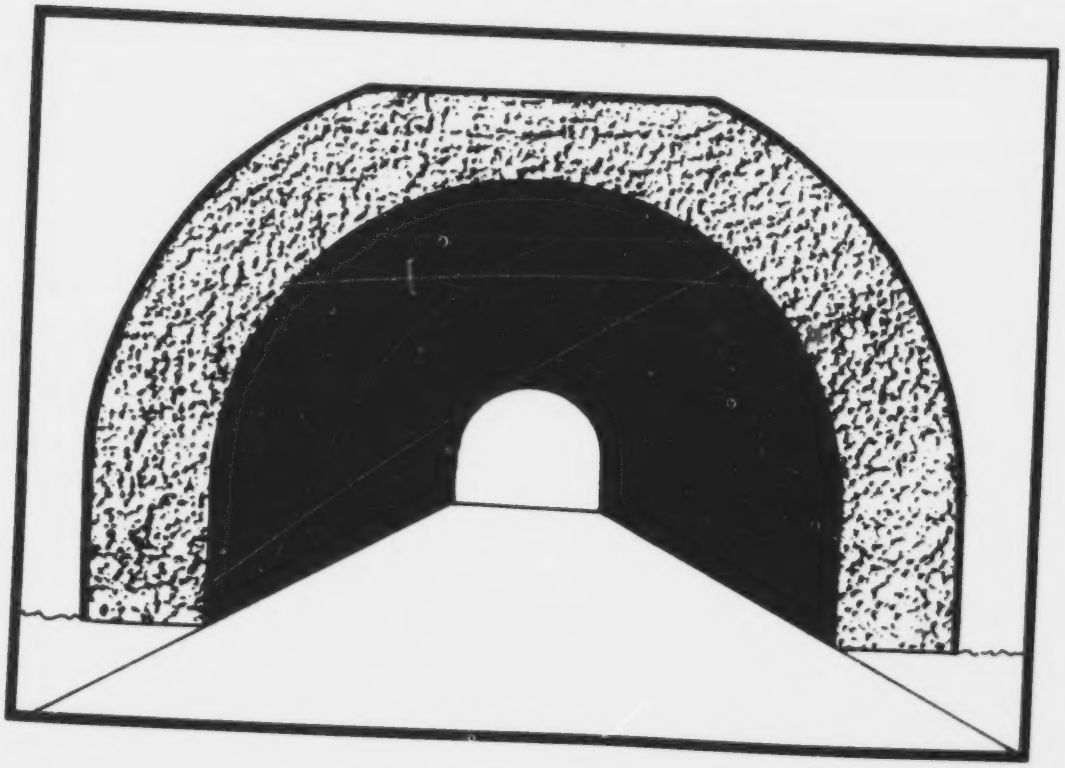


The portal is the doorframe of the tunnel. During the reconnaissance you identify the material of the portal.

Study this diagram of a typical portal made of masonry.

① Parts of a Tunnel (Cont.):

TUNNEL PORTAL



This diagram is a typical ***portal*** made of ***concrete***.

Turn the page and do the practice exercises.

PRACTICE EXERCISES:

WRITE YOUR ANSWERS TO THESE QUESTIONS ON A BLANK SHEET OF PAPER.

1. List the three main parts of tunnels.

2. List the three types of tunnel linings.

3. List the most common shapes for tunnel bores.

Check your answers on the next page.

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CHECK YOURS ANSWERS:

1. The three main parts of a tunnel are:

   Bore, liner, portal

2. The three main types of tunnel linings are:

   Unlined

   Masonry Lined

   Concrete Lined

3. The most common shapes for tunnel bores are:

   Square with arched ceiling

   Elliptical

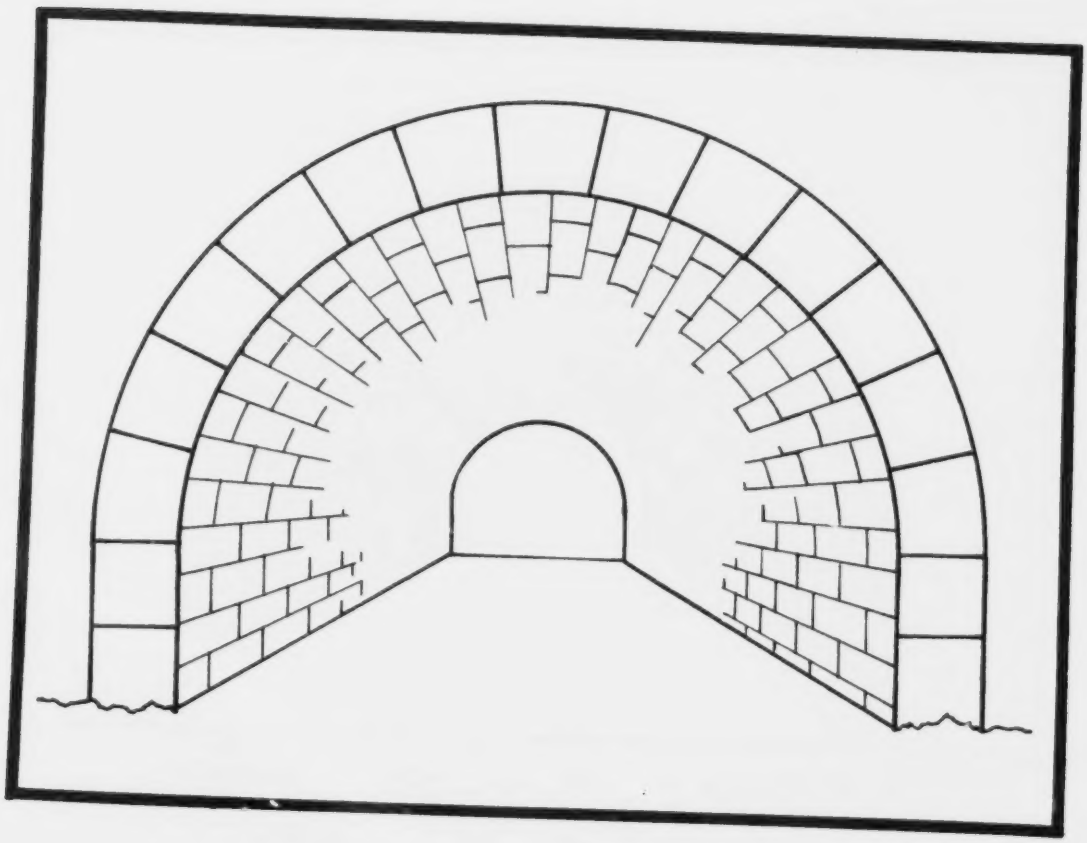
   Horse-shoe

   Semi-circular

If you had no difficulty with these practice exercises, proceed.

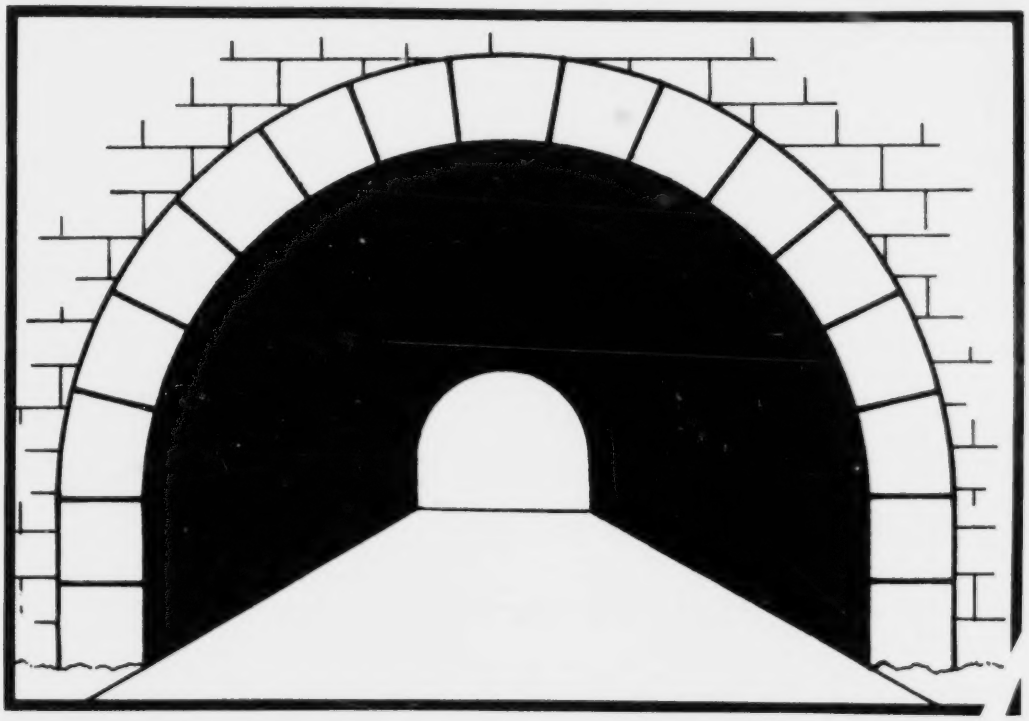
PRACTICE EXERCISES (Cont.):

4. What is the ***lining*** material of this tunnel?



PRACTICE EXERCISES (Cont.):

5. What is the ***portal*** material of this tunnel?



Check your answers on the next page.

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CHECK YOUR ANSWERS:

4. This tunnel is masonry-lined.

5. This ***portal*** is made of ***masonry.***

You have now completed the first step of this lesson. When you are ready, proceed to Step Two.

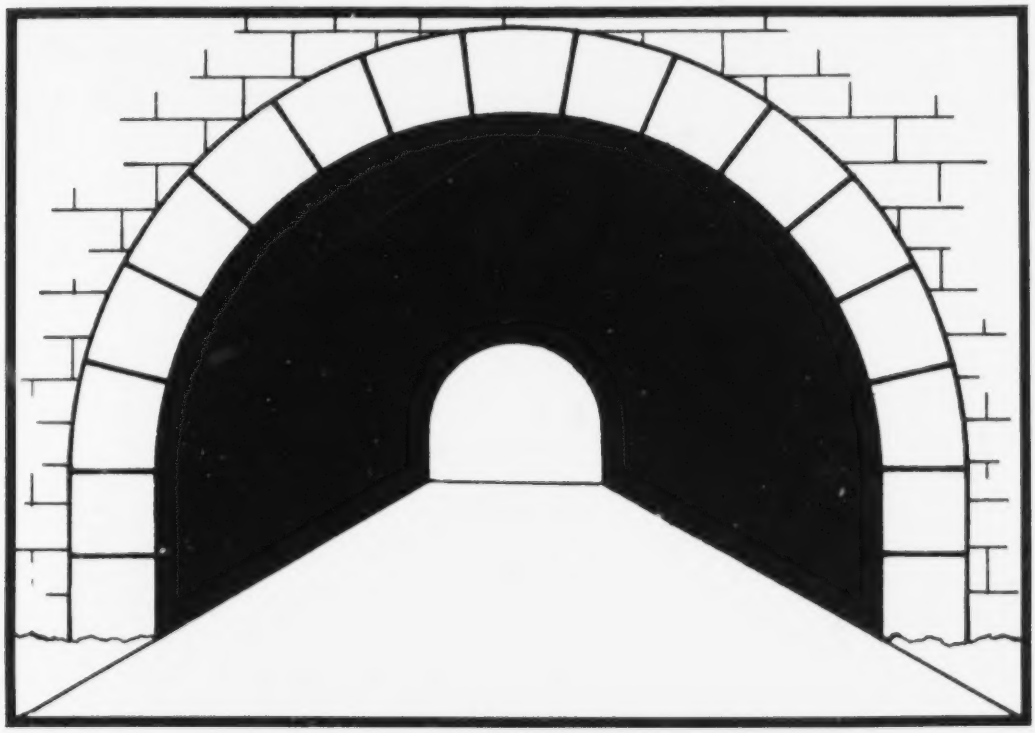
② Obtain Required Tunnel Dimensions and Measurements

In this section you will learn how to obtain tunnel dimensions and measurements necessary for preparing DA Form 1250, Tunnel Reconnaissance Report.

Turn the page to).

② Obtain Required Tunnel Dimensions and Measurements (Cont.):

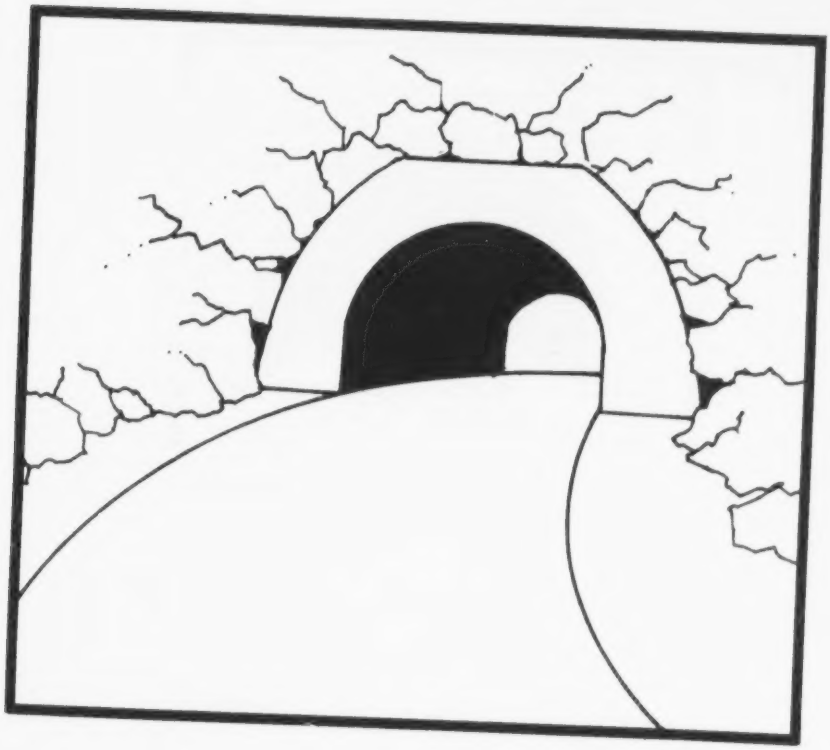
TUNNEL ALIGNMENT



Determine the alignment of the tunnel. The alignment of the tunnel tells you what type of dimensions and measurements to obtain. The alignment will be either ***straight*** or ***curved.***

Study this diagram of a tunnel with a straight horizontal alignment. Notice that the road is straight through the tunnel.

② Obtain Required Tunnel Dimensions and Measurements (Cont.):

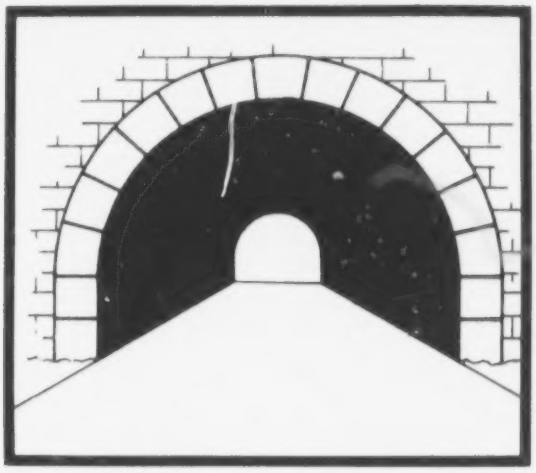


This visual shows a tunnel with curved horizontal alignment. Notice that the road curves inside the tunnel.

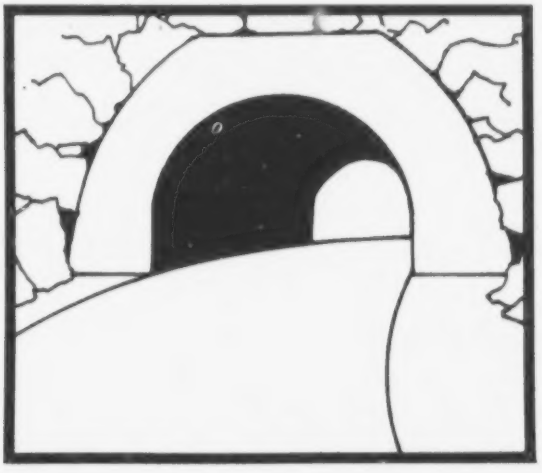
Turn the page for some practice.

PRACTICE EXERCISES:

6. What is the alignment of this tunnel?



7. What is the alignment of this tunnel?



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CHECK YOUR ANSWERS:

6. This tunnel has a straight alignment.

7. This tunnel has a curved alignment.

Proceed.

(2) Obtain Required Tunnel Dimensions and Measurements (Cont.):

During a tunnel reconnaissance you obtain the following dimensions and measurements:

Tunnel length portal-to-portal

Tunnel length along centerline

Radius of curvature of traveled way

Percent of slope of traveled way

Changes in percent of slope

Width of traveled way

Horizontal clearance

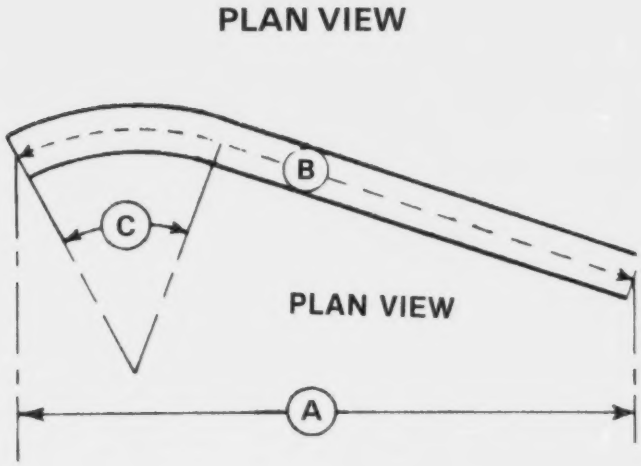
Overhead clearance

Rise of tunnel arch

Refer to your FM 5-34 and study the diagrams for obtaining tunnel dimensions and measurements.

When you finish, return to this lesson and study the diagrams on the following pages. You may refer to FM 5-34 at any time.

(2) Obtain Required Tunnel Dimensions and Measurements (Cont.):



Study this diagram of a tunnel Plan View for obtaining these dimensions and measurements:

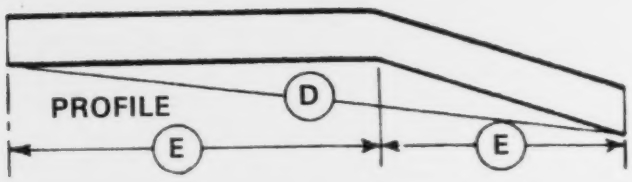
A. TUNNEL LENGTH: measure from portal-to-portal.

B. TUNNEL LENGTH ALONG CENTERLINE DISTANCE: measure the center-line distance of the tunnel only if there is a curvature within the tunnel.

C. RADIUS OF CURVATURE: if there is a curvature within the tunnel, measure the radius of the curvature along the traveled way. You may estimate this dimension.

(2) Obtain Required Tunnel Dimensions and Measurements (Cont.):

PROFILE VIEW



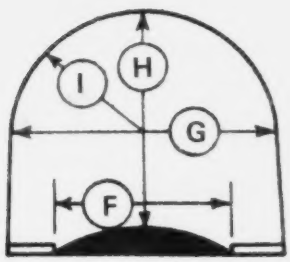
Study this diagram of a tunnel Profile View for obtaining these dimensions and measurements:

D. PERCENT OF SLOPE: if there is a gradient within the tunnel, measure a percent of slope of the traveled way between the portals.

E. CHANGES IN PERCENT OF SLOPE: measure any changes in the percent of slope within the tunnel.

② Obtain Required Tunnel Dimensions and Measurements (Cont.):

PORTAL VIEW



Study this diagram of the Portal View of a tunnel for obtaining these dimensions and measurements:

F. EFFECTIVE WIDTH OF THE TRAVELED WAY: measure the width from curb-to-curb.

G. HORIZONTAL CLEARANCE: measure the minimum width of the tunnel bore four (4) feet above the traveled way.

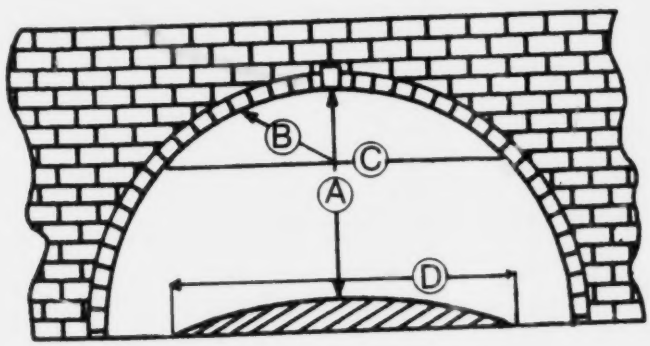
H. OVERHEAD CLEARANCE: measure the minimum distance between the top of the traveled way and the lower edge of the ceiling or any obstruction below the ceiling.

NOTE: You report an overhead clearance as an obstruction if it is less than 4.3 meters.

I. RISE OF THE TUNNEL ARCH: measure the radius of the curved portion of the tunnel.

PRACTICE EXERCISES:

For the following exercises you may use FM 5-34, and you may refer back in the lesson. Number your paper 8-11. Study the following portal view of a tunnel. Place the proper letter next to the measurement taken at that spot.



8. Horizontal clearance _____

9. Rise of tunnel arch _____

10. Overhead clearance _____

11. Width of traveled way _____

12. At what height do you report overhead clearance as an obstruction?

CHECK YOUR ANSWERS:

8. Horizontal clearance C

9. Rise of tunnel arch B

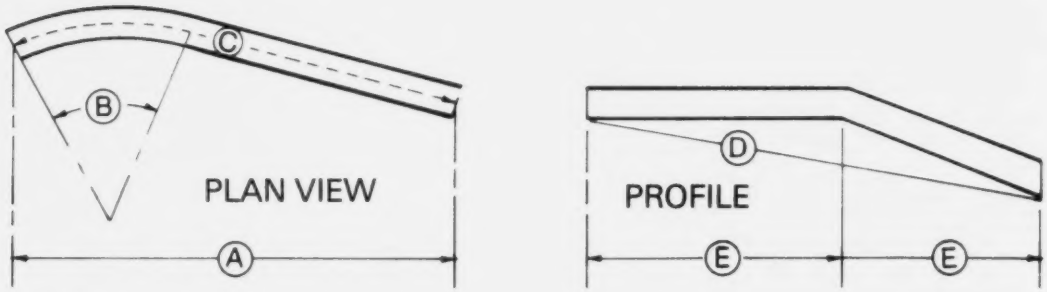
10. Overhead clearance A

11. Width of traveled way D

12. 4.3 meters

If you had no difficulty with these exercises, then try some more.

Number your paper 13-17. Study the following Plan View and Profile View of a tunnel. Place the proper letter next to the measurement taken at that spot. You may refer to FM 5-34 and this lesson.



13. Percent of slope _____

14. Portal-to-portal length of tunnel _____

15. Centerline of curvature of traveled way _____

16. Change in percent of slope _____

17. Radius of curvature of traveled way _____

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CHECK YOUR ANSWERS:

13. Gradient D

14. Portal-to-portal length of tunnel A

15. Centerline of curvature of traveled way C

16. Change in gradient E

17. Radius of curvature of traveled way B

You have now completed all the practice exercises in this lesson. At this time review any sections you are unsure of.

When you are ready, ask for the lesson test. Good luck!

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PRETEST/POSTTEST ANSWER KEY

Each of the 10 questions has a value of 10 points. The total possible score is 100 points. You must answer all questions correctly to pass this test.

1. B
2. D
3. A
4. C
5. E
6. D
7. A
8. B
9. C
10. An overhead clearance is considered an obstruction when it is less than 4.3 meters.

☆ U.S. Government Printing Office: 1985—461-063/34396